FRD Activities Report
March 2002

Research Programs

URBAN 2000/VTMX

We are in the process of documenting the meteorological measurements made by FRD during the URBAN 2000/VTMX field project. The project was conducted in Salt Lake City in October 2000. FRD fielded two 3-D sonic anemometers, a radar profiler with RASS, a sodar and a surface meteorological station. The sonic anemometers were placed on a mast mounted in the wake of a building near the downtown SF_6 tracer dissemination point. The remainder of the instruments were deployed in a suburban area near the north-central portion of the Salt Lake Valley. Figure 1 shows a summary graph of the sonic anemometer data for 7 nocturnal intensive observation periods (IOPs) when the tracer was disseminated. Most IOPs were quite similar except for IOP9, which had a wind speed nearly two times that of the other IOPs. The average kinematic sensible heat flux was positive only during IOP 1. (Kirk.Clawson@noaa.gov, Jerry Crescenti)

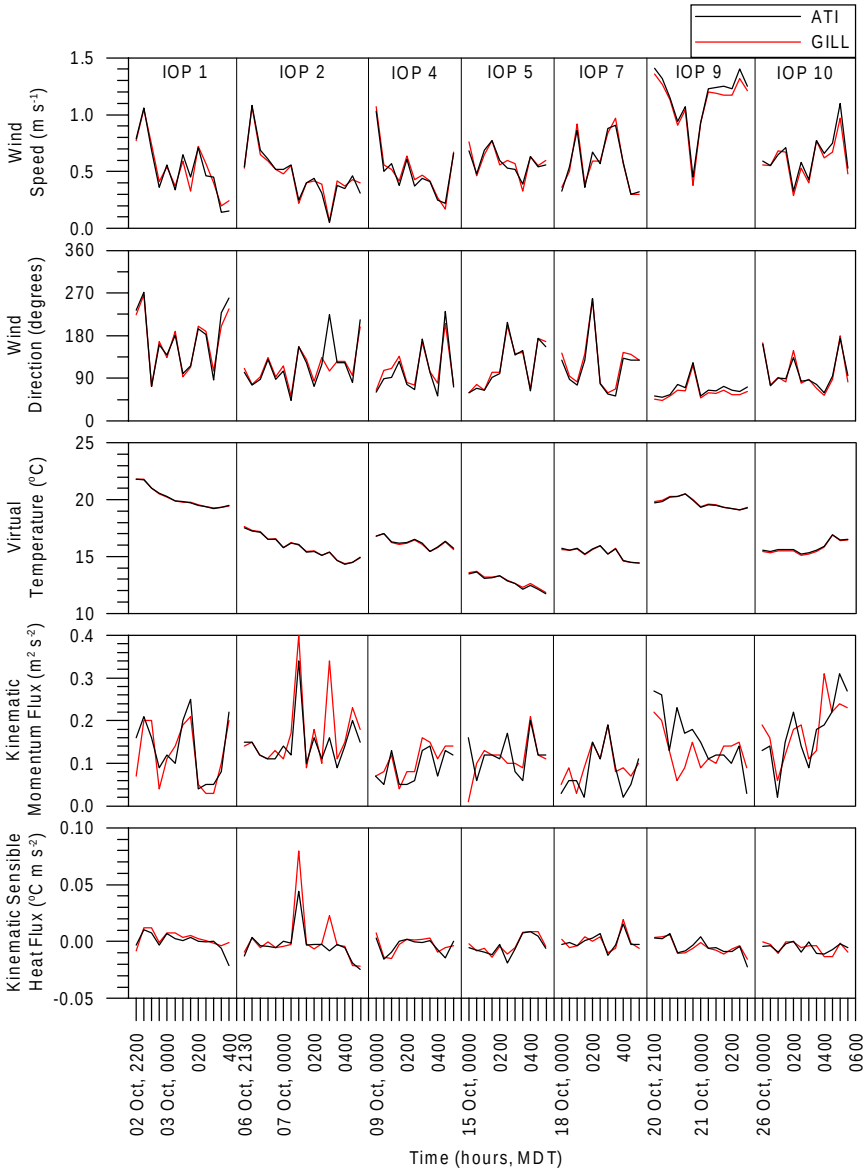

Figure 1. Gill and ATI 3-D sonic anemometer 30-min average responses for the seven nocturnal IOP deployment periods.

IMS Development

On March 21, we received matching funds from the U.S. Army and ARL to develop an Ion Mobility Spectrometry (IMS) based instrument for measuring atmospheric tracers. In order to speed the development, we are working in parallel on several tasks. We have contacted the U.S. Nuclear Regulatory Commission and begun working on an application to handle low-level radioactive material that may be required for ionization sources in the instrument. We are also investigating the possibility of contracting with a university or another company to handle the sources for us. At the same time, we are constructing two prototype instruments that will allow us to begin testing various components and ionization sources. The first is very simple and should be operational in a few days, assuming parts that have been ordered arrive as promised. The goal of the project is to develop a smaller, cheaper, more adaptable tracer instrument. (Roger.Carter@noaa.gov, Debbie Lacroix, Shane Beard)

New Sampler Pump Flow Control

A standard Sensydine "A Series" micro pump with a datalogger has been set up to test a number of flow rate control possibilities for an upgraded atmospheric tracer sampler. Since the pump will be powered by a single 1.5 volt alkaline battery, it is essential that the control technique be as power efficient as possible. Therefore, any control technique should eliminate or minimize linear regulation to the motor control due to the energy loss through the series regulating output; and it should measure flow with a minimum of back pressure. Three control techniques were tested and included the following:

(1) Constant voltage generated by a high efficiency, micro-power switching power supply with continuous pulse width modulation to control the average pump rate. The pulse width modulation is provided by the datalogger for testing purposes and would ultimately be provided by the microprocessor in the sampler.

(2) A variable voltage from a high efficiency, micro-power switching power supply which is controlled by a continuous analog output on the datalogger for testing purposes and would ultimately be controlled by an analog output on the sampler microprocessor.

(3) Constant voltage generated by a high efficiency, micro-power switching power supply with the pump turned on and off on every few seconds, with each on time delivering a constant volume. The on/off control is provided by the datalogger for testing purposes and would ultimately be provided by the microprocessor in the sampler.

Note: In all of the cases described above, flow is measured by a differential pressure sensor placed across a flow restriction or metering orifice.

The best results for continuous flow was provided by the second technique. However, it is not nearly as efficient, does not have as wide a flow control range as the third technique, requires an analog output that would need to be added to the microprocessor, and is more complicated to implement in both hardware and software. The first technique had a wider range of fluctuation in

the flow rate due to variations in pressure across the metering orifice caused by variations in the on/off cycle of the pump. Since the pump tries to maintain a continuous flow rate, it has less flow range capability. (Randy.Johnson@noaa.gov)

Cooperative Research with INEEL

Emergency Operations Center (EOC)

An exercise was held at the INEEL Emergency Operations Center (EOC) on 26 March. Two staff members from FRD attended the exercise. The EOC is now using an Information Management System, which involves filling out triplicate message forms. So much for the "paperless office" concept. (Richard.Eckman@noaa.gov, Debbie Lacroix)

INEEL Support

About 800,000 runs of the MDIFF dispersion model were completed in March as part of a dispersion study at INEEL. The output from these runs was used to compute medians and 95th percentiles for the total integrated concentration (TIC). Figure 2 shows isopleths for the 95th percentile TIC based on a one-hour surface release at the INTEC facility. The TIC is normalized by the total quantity Q of material released from the source, so the units are s m^{-3}. The northeast-southwest channeling of the wind in the Snake River Plain is clearly evident in the figure. However, the facilities closer to the mountains west of INEEL showed deviations from this pattern. Figure 3, for example, shows the 95th percentiles for TAN, which is at the north end of the site. This facility appears to be affected by flows coming out of the side valleys that feed into the Snake River Plain.

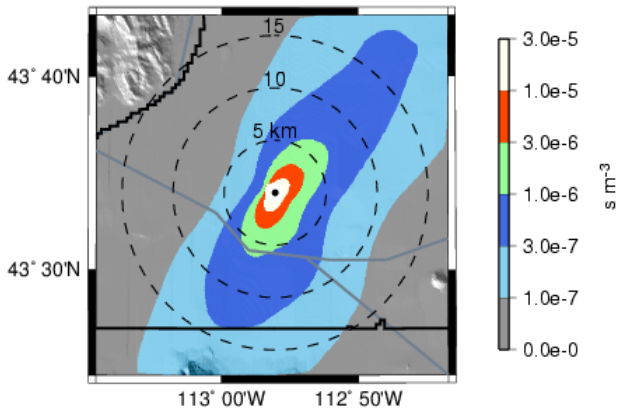

Figure 2. Isopleths of the 95th percentile value of TIC/Q for a set of 1-hour surface releases from the INTEC facility. The heavy solid lines show the INEEL site boundary.

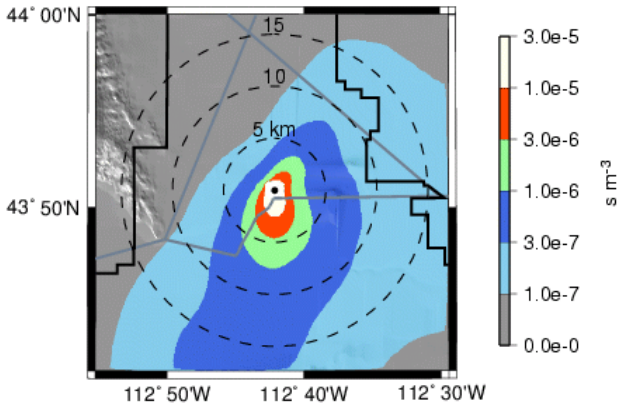

Figure 3. Isopleths of the 95th percentile value of TIC/Q for a set of 1-hour surface releases from the TAN facility. The heavy solid lines show the INEEL site boundary.

Another meeting of the INEEL Water Board took place on March 28 . The main topic was finalizing the charter for the board. FRD protested the wording in the draft charter, because it appeared to give the Water Board authority over atmospheric water, but relegated FRD to nonvoting member status. The attendees agreed to remove atmospheric water from the charter. It appears that the primary motivation for creating the Water Board is to address ground water issues at INEEL, so it is not expected that atmospheric issues will play much of a role. (Richard.Eckman@noaa.gov)

One issue that came up in March was that some people were confusing the ratio TIC/Q with X/q, where X is the concentration and q is the release rate. Both ratios have the same units but different meanings and generally different values. A meeting was held at the end of the month with INEEL personnel to discuss this issue and determine which ratio is most appropriate for the intended applications of the MDIFF statistics. It was also pointed out at this meeting that for most locations in the MDIFF domain, more than 50% of the TIC values from the runs are zero. (i.e., the plume "hit" the location less than 50% of the time). This must be considered when interpreting the statistics. For example, plots of the median TIC are uninteresting, because the medians are zero everywhere but a small area close to the source. (Richard.Eckman@noaa.gov)

INEEL Mesoscale Modeling

During part of March, the MM5 runs at FRD showed a large negative bias in the forecast temperatures at both Idaho Falls and INEEL. It was determined that the bias was due to the model's snow-cover initialization. The initial snow cover for the MM5 runs comes from the NCEP Eta model's output. The Eta model insisted on putting a broad mound of snow out in the middle of the Snake River Plain during parts of March. A quick look out the window and a check of the satellite pictures indicated that no such mound existed. MM5 would spend most of the forecast day melting off this snow, which led to unrealistically cold temperatures and other problems. Even though MM5 often melted this snow within 12 hours or so, the reinitialization of the model with Eta output on the following day would put the snow mound right back in. MM5 was therefore forced to melt the same snow over and over on sequential days. The mound eventually disappeared from the Eta output later in March. (Richard.Eckman@noaa.gov)

Community Monitoring Stations

In October 2001, the Rexburg Middle School and Blackfoot Middle School Community Monitoring Stations were equipped with new hardware (Campbell Scientific CR23X) and software that would allow these stations to communicate on the FRD mesonet data telemetry network and send serial data to the existing Light Emitting Diode (LED) display signs. The new Wind Chill Temperature index from the National Weather Service was available and was implemented for these two new stations. However, it was implemented without checking for speeds below 3 miles per hour, which is the minimum wind speed for this calculation. Therefore the displays would display wind chill temperatures greater than actual temperature at low wind speeds. The program used in the Campbell Scientific CR23X has been modified to test for low wind speed conditions before sending the calculated Wind Chill Temperature to the LED display signs. (Randy.Johnson@noaa.gov)

INEEL Mesonet Radio Narrowbanding

Teresa Maraia at the NOAA Boulder Radio Frequency Management Office has been contacted requesting a waiver to narrowbanding our mesonet radio frequency. Presently we will be required to convert or upgrade the present equipment from 25 kHz spacing to 12.5 kHz unless a waiver is granted. Campbell Scientific has been contacted to determine if it would be practical to modify the existing radios to narrowband. Their communications expert, Joe Thurston, has indicated that it would be cost prohibitive to make the modifications to the old radios and we would still have outdated radios that are no longer manufactured. Teresa has forwarded the waiver request to Richard Barth and Scott Jackson (NESDIS Headquarters/Office of Radio Frequency Management in Silver Springs, MD). If a waiver is not granted, it will be necessary to purchase replacement radios prior to January 2005. (Randy.Johnson@noaa.gov)

Other Activities

NOAA LongEZ N3R

Last month we reported the major conclusions from GSA's Interagency Committee for Aviation Policy (ICAP) Aviation Resource Management Survey (ARMS) report on ARL use of LongEZ N3R. We were pleased that the ARMS review found the Long EZ operations by FRD not only safe and efficient but also quite cost effective. In addition to the usual thirteen review areas, OMAO had specifically requested the ARMS suggest how to best continue the use from an administrative standpoint. On 5 March, OMAO and OAR management met and agreed to implement the ARMS recommendation that the LongEZ should be leased, placed under Aircraft Operations Center (AOC) operational control, but leaving functional control with ARL. ARL is developing the lease in cooperation with AOC. FRD is also working with AOC to develop necessary operational procedures. (Tim.Crawford@noaa.gov, Richard Artz and Thomas Watson)

AMS Short Course

Jerry Crescenti will be one of several instructors for the American Meteorological Society (AMS) *Short Course on the Fundamentals of Boundary Layer Wind and Turbulence Profiling using Radar and Acoustic Techniques*. This two-day course is sponsored by the AMS Measurements Committee and will be held on February 8-9, 2003 in Long Beach, California, in conjunction with the 83rd AMS Annual Meeting and the Twelfth Symposium on Meteorological Observations and Instrumentation. Crescenti will provide instruction on sodar siting and noise avoidance issues. (Jerry.Crescenti@noaa.gov)

Proposals

FRD has been asked to participate in a proposed workshop on the modeling of atmospheric dispersion related to weapons of mass destruction. Funding for the workshop is being requested

through the U.S. Civilian Research & Development Foundation. The proposed effort is a collaboration between INEEL and a group of Russian scientists. If the workshop is funded, the intention is to send one participant from FRD and a second from ARL Headquarters. (Kirk Clawson, Richard Eckman)

Papers Reviewed

Barthelmie, R. J., L. Folkerts, F. T. Ormel, P. Sanderoff, P. J. Eecen, O. Stobbe, and N. M. Nielsen, 2002: Offshore wind turbine wakes measured by sodar. *J. Atmos. Oceanic Technol.*, reviewed by Jerry Crescenti.

Irwin, J. S., and E. Canepa, 2002: Validation of air pollution models. Web-based text book: Air Pollution Modeling Theories, Computational Methods, & Available Software, reviewed by Kirk Clawson.